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## Faculty Working Papers

AN ANALYSIS OF BUSINESS RISK IN COMMERCIAL BANKING

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Summary

Business risk, which arises due to variability in a firm's sales and its use of operating leverage, is not usually associated with commercial banks. In this study banks are characterized as having a significant degree of business risk due to the "fixed costs" of a relatively stable deposit base. The degree of business risk varies across banks depending on the relative size of this stable deposit base. A proxy for business risk, variability in earnings before interest and taxes, is developed. This proxy is related to proxies for financial risk and other bank characteristics, and is used in a multivariate explanation of average market return.





# AN ANALYSIS OF BUSINESS RISK IN COMMERCIAL BANKING

## I. Introduction

In corporate finance it is common to decompose the riskiness of a firm into business risk and financial risk. This categorization allows one to analyze separately the sources of risk that are inherent in most firms. Business risk is usually viewed as the uncertainty associated with future operating earnings. It arises due to uncertainty in sales and the degree of operating leverage employed by the firm. Financial risk refers to uncertainty in future net income due to the fixed costs of using debt financing or financial leverage.

A large amount of research in finance has had its focus on these two measures of risk, their determinants and even their interaction. This research has examined firms in a variety of industries; however financial firms have usually been neglected. In this study we wish to fill part of this gap by examining the role of business risk in commercial banking. This requires that business risk be defined for banks and that measures of business risk be developed. Once business risk has been defined and proxies developed, we will explore the determinants of business risk, the interaction between business and financial risk in commercial banking, and the role of business risk in determining commercial bank returns. The remaining sections of this study follow this approach.

## II. Business Risk in Banking

Business risk can be defined as ". . . the uncertainty inherent in projections of future operating income, or earnings before interest

and taxes (EBIT)." [3, p. 512] This uncertainty or variability arises in part from the variability of expected sales or operating revenue, and in part from the use of operating leverage. These concepts, especially operating leverage, are less clear in commercial banking than in other industries. In examining business risk in banking we utilize a view of the commercial banks as a depository financial institution as expressed by Sealey and Lindley [16]. That is, the output of a bank is measured by its earning assets and its inputs consist of loanable funds that are acquired or produced by the operations of the firm (its deposit and borrowing activities). The earning assets of a bank represent contracts to "rent" credit under specified conditions. These rentals produce a flow of revenues and a flow of costs due to the continuing activity of the bank to maintain the source (or inventory) of and the demand for loanable funds.

Bank sales, primarily the revenue from its earning assets, will vary over time due to a variety of influences. The quantity or dollar amount of credit extended will be influenced by economic conditions and price. The prices charged (nominal rates) on loans will vary depending on cost factors, strength of demand, risks inherent in the credit extended, and competitive position of the bank. A bank that uses a variable rate pricing scheme for its loans will introduce additional variability into its operating revenues.

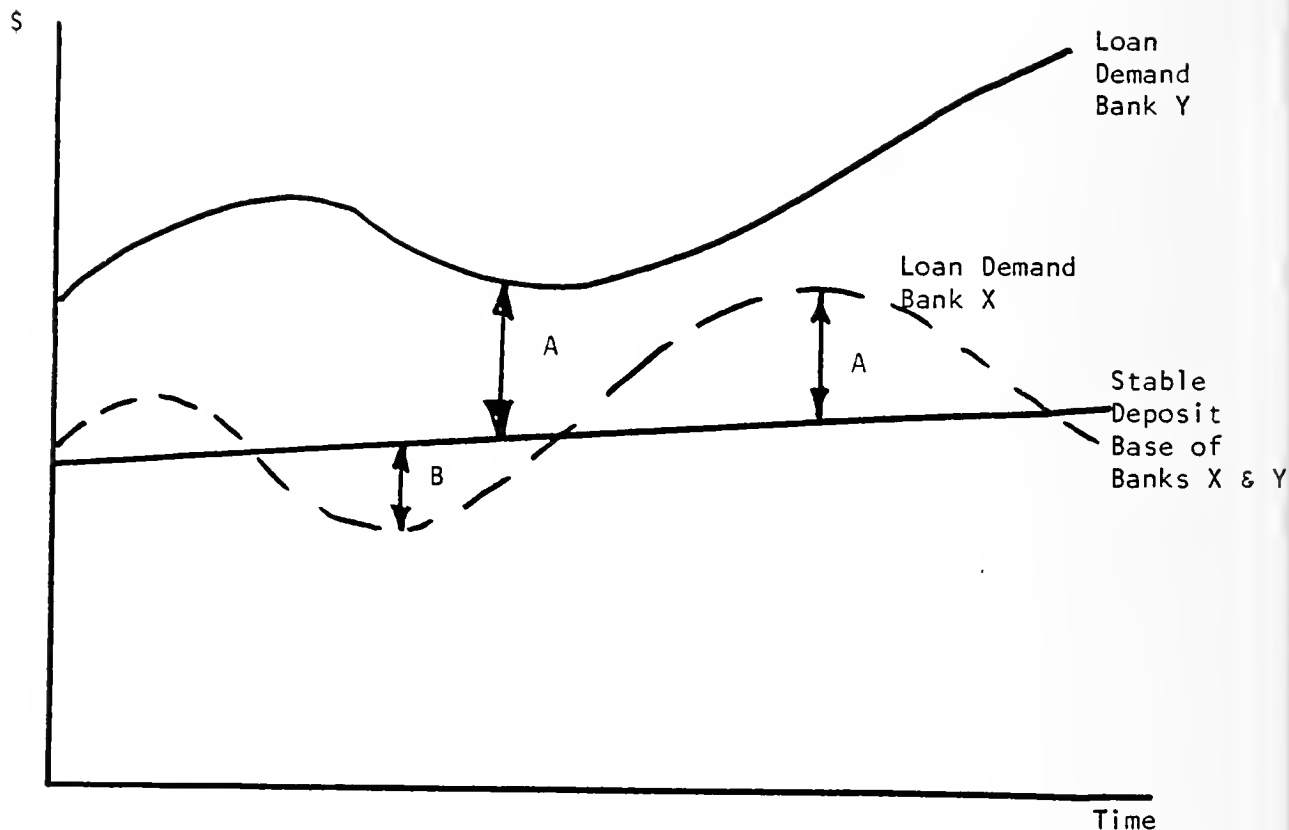
The concept of operating leverage requires that the costs of a bank be divided into fixed and variable components. This is necessary to identify the contribution of operating leverage to the variability in earnings. Since the production process of a bank does not employ

large amounts of (physical) capital assets as is the case for many industrial firms, identification of fixed costs is a delicate task.

A bank does have a small amount of fixed cost due to its facilities, equipment, and managerial personnel. A large portion of a bank's other costs are related to the gathering of its loanable funds inputs. The largest single cost is the interest cost of obtaining these loanable funds. Without doing severe violence to reality we can characterize a large portion of these funds gathering (personnel and interest) costs as fixed. In doing this we view a portion of the bank's funds source as relatively stable with a relatively stable cost. This would include much of the demand deposit source of funds, and the savings and small time deposit source of funds. The costs associated with the demand deposit source are those costs of attracting and servicing these deposits. The savings and small time deposit costs include attracting and servicing costs along with interest costs. These costs are all relatively fixed due to tradition and regulation (such as Regulation Q). Similarly much of the production costs, the costs of producing the earning assets, are fixed. These costs include mostly personnel costs associated with the sales force (loan officers, bond department, credit department).

Variable costs include those personnel and interest costs associated with acquiring loanable funds inputs over and above the stable deposit base (demand, savings, and small time deposits) to satisfy loan demand in excess of the deposit base (see Figure 1). Since a loan demand in excess of the stable deposit base may also be satisfied by the sale of securities, the costs associated with this activity should also be included in variable cost. To the extent that a bank's stable

Hypothetical Deposit Base and Loan Demands



Bank X represents, perhaps, a retail bank with a stable deposit base large relative to loan demand. At A the bank would sell securities and/or purchase funds; at B the bank would buy securities. Bank Y has a stable deposit base that is small relative to its loan demand.

deposit base is large (small) in proportion to its loan demand, a smaller (larger) proportion of its total costs will be variable costs and thus the larger (smaller) will be its degree of operating leverage. And since operating leverage magnifies the variability of sales that is "passed through" to EBIT, the percentage change in EBIT per dollar of sales would be greater for those banks with a large stable deposit base relative to loan demand.

By viewing fixed and variable costs in this manner banks will experience significant degrees of operating leverage which are usually associated with capital intensive industries. These levels of operating leverage may then be a significant component in the business risk experienced by a commercial bank. And, those banks with a larger proportion of funds from a stable deposit base (e.g., regional or retail banks) may have higher levels of business risk than those banks which depend more heavily on purchased funds (e.g., money center banks).

### III. Previous Research

Many empirical studies have had business risk as their focus. The issues examined in these studies have included (1) various ways of proxying business risk, (2) the relationship between business and financial risk, and (3) the impacts of size and growth on business risk. Few of these studies examine the commercial banking industry.

Business risk and/or operating leverage have been proxied in a variety of ways. As a measure of business risk Wipperfurth [18] used the antilog of the standard error around a logarithmic regression of annual net operating income per share on time over a ten year period. Gonedes

[6] used deviations of annual rates of growth in net operating income from the ten-year compound growth rate as a business risk measure.

Ferri and Jones [4] utilized several business risk proxies in examining the relationship between business risk and financial leverage. These were the coefficient of variation in sales and pre-tax cash flows and the standard deviations of the standardized growth in sales and cash flow. In addition Ferri and Jones measured operating leverage by calculating the degree of operating leverage for two periods and by using a net fixed assets to total assets ratio.

Martin, Scott and Vandell [10] suggested that business risk is multivariate in nature and utilized six factors in an analysis of business risk. These factors, described as environmental and firm unique factors, are: (1) the ratio of firm sales to the average firm sales in the industry; (2) the variance about a log-linear trend in firm sales per share; (3) the ratio of the variance about log-linear trend in "pre-financing" earnings per share to the similar measure in sales per share; (4) growth, as measured by the antilog of the slope coefficient of the log-linear trend in prefinancing earnings per share; (5) product diversification represented by the ratio of the covariance in firm and industry sales to the product of the standard deviations of firm and industry sales; (6) size as measured by sales.

Brigham suggests that business risk is, perhaps, "the most important determinant of a firm's capital structure." [3, p. 512] Firms with low (high) business risk may utilize high (low) financial leverage. Ferri and Jones reported virtually no relationship between their business risk and financial leverage proxies but that the operating leverage

proxy was negatively related to the percentage of debt in a firm's financial structure.

The impact of growth on business risk is difficult to determine. Myers [14], in reviewing several empirical studies, observed that there is a long tradition in the finance literature relating rapid growth to high business risk. However, Martin, Scott and Vandell suggest that growth indicates profitable investment opportunities and higher growth lowers business risk. Martin, Scott and Vandell included EBIT growth as one variable in their multidimensional concept of business risk. Also, Ferri and Jones included sales and cash flow growth rates as business risk proxies. With respect to size, Myers has noted that ". . . theory predicts that large firms will have lower total risks" [14, p. 52]. Martin, Scott and Vandell included size as a factor in their multidimensional framework for business risk. Ferri and Jones, and Scott and Martin [17] both report a positive relationship between size and financial leverage.

Studies of risk in the commercial banking industry have usually had a focus on financial risk or capital adequacy, but not on business risk. For example, the impact of financial risk on stock price (Beighley, Boyd and Jacobs [2]) and on dividend yield (Mehta, Eisemann, Moses and Deschamps [11]) have been recently examined. Magen [8] and Sachlis and Haslem [15] do consider business risk in banking. Magen has proposed, and Sachlis and Haslem test, the notion that banks adjust their business and financial risk simultaneously to achieve some overall optimum level of risk. This hypothesis is supported by Sachlis and Haslem.

#### IV. Variables and Data

This study uses the uncertainty or variability in earnings before interest and taxes (EBIT) on a per share basis as a proxy for business risk. EBIT for commercial banks is earnings before interest on long term debt and taxes. All interest on deposits and borrowings is considered to be a factor payment for the loanable funds input of the bank and is thus viewed as an operating expense. A bank's long term debt (debentures, capital notes, leases) is part of its capital<sup>1</sup> and affects the financial leverage of the bank.

Besides variability of EBIT per share ( $EBIT_v$ ), the variability in sales per share ( $SALES_v$ ) and earnings per share ( $EPS_v$ ) are utilized. These measures are the variances about a log-linear trend in sales, EBIT and earnings per share. The trend equation used is

$$(1) \quad \log (\tilde{X}_{jt}) = a_j + b_j \tilde{T}_t + \tilde{e}_{jt}$$

where  $\tilde{X}_{jt}$  is sales per share, EBIT per share, or earnings per share for firm  $j$  in period  $t$ .  $a_j$  and  $b_j$  are regression constants,  $\tilde{T}_t$  is the time variable for period  $t$ , and  $\tilde{e}_{jt}$  is the error term. The growth variables are the slope coefficient ( $b_j$ ), from the three trend equations, or  $SALES_g$ ,  $EBIT_g$  and  $EPS_g$ .

Financial leverage or financial risk is measured two ways. First, the inverse of the familiar interest coverage ratio is used:

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<sup>1</sup>Long term debt includes all debentures, capital notes and leases whether or not classified as "capital" by a bank regulator.



$$(2) \quad FR_1 = \frac{\sum_{t=1}^{31} I_t}{\sum_{t=1}^{31} EBIT_t}$$

where  $I_t$  and  $EBIT_t$  are the long term debt interest obligations and earnings before long term debt interest and taxes in period  $t$ , respectively.

The second financial leverage measure is:

$$(3) \quad FR_2 = \frac{\sum_{t=1}^{31} LTD_t}{\sum_{t=1}^{31} EQ_t}$$

where  $LTD_t$  represent all of a bank's long term debt in period  $t$ .  $EQ_t$  represents a bank's total equity which is the sum of all equity accounts and the loan loss reserve. The loan loss reserve is included since this item is essentially capital that has been set aside to serve a specific purpose. The size variable is represented by the natural log of the average of total assets (TA) over the 31 quarters.

$$(4) \quad SIZE = \log \left( \frac{1}{31} \sum_{t=1}^{31} TA_t \right)$$

Market return, the return on common stock is

$$(5) \quad MR = \left\{ \frac{1}{31} \sum_{t=1}^{31} \left[ \frac{P_t - P_{t-1} + D_t}{P_{t-1}} \right] \right\} \frac{1}{31}$$

where  $P_t$  and  $D_t$  are the stock price and dividend per share paid in period  $t$ .

The sample of commercial banks and bank holding companies used for the empirical work includes 55 companies taken from the quarterly Bank Compustat tape. Companies with available data for the 31 quarters 1971:1 through 1978:3 were selected. Because of the measure of uncertainty used here, only banks with non-negative EBIT were included. Table 1 presents information on the variables employed in this study. The Appendix contains a list of the banks and bank holding companies included in the sample.

#### V. Empirical Results

Business risk has been proxied by the "variability" (as defined in Section IV) of EBIT. Table 2 presents the correlations among the various variables used in this study. Part of the variability of EBIT comes from variability in sales, and Table 2 shows that across the 55 banks these two measures of variability are positively correlated, but not significantly so (at the 0.05 level). This suggests that operating leverage, the structure of fixed and variable costs, varies across banks causing bank EBIT variability to not be closely related to sales variability. This would be expected since it was argued that different banks have differing degrees of stable deposit bases and thus different operating leverage. Table 1 indicates that the mean EBIT variability among the 55 banks is nearly three times larger than sales variability. This larger variability in EBIT is due in part to the use of operating leverage in banks. In comparing EBIT variability with EPS variability we find they are significantly and positively correlated. This suggests that the use of financial leverage, which accounts for the EBIT-EPS difference, is rather similar across these 55 banks.

TABLE 1

Variable Values for 55 Commercial Banks

<u>Variable*</u>	<u>Mean</u>	<u>Standard Deviation</u>	<u>Minimum Value</u>	<u>Maximum Value</u>
SALES <sub>v</sub>	.0221	.0177	.0051	.0671
SALES <sub>g</sub>	.0318	.0087	.0029	.0562
EBIT <sub>v</sub>	.0622	.0807	.0053	.3423
EBIT <sub>g</sub>	.0217	.0144	-.0151	.0546
EPS <sub>v</sub>	.0323	.0391	.0030	.1845
EPS <sub>g</sub>	.0185	.0118	-.0105	.0402
FR <sub>1</sub>	.1140	.0919	.0000	.4847
FR <sub>2</sub>	.2449	.1626	.0000	.7592
SIZE	8.0427	.9104	6.4977	10.5840
MR	.0163	.0109	-.0091	.0421

\*Variables are defined in Section IV.

TABLE 2

Correlation Matrix of Variables for 55 Banks

	SALES <sub>v</sub>	EBIT <sub>v</sub>	EPS <sub>v</sub>	SALES <sub>g</sub>	EBIT <sub>g</sub>	EPS <sub>g</sub>	FR <sub>1</sub>	FR <sub>2</sub>	SIZE	MR
SALES <sub>v</sub>	1.000									
EBIT <sub>v</sub>	.217	1.000								
EPS <sub>v</sub>	.207	.816*	1.000							
SALES <sub>g</sub>	.221	-.443*	-.413*	1.000						
EBIT <sub>g</sub>	-.178	-.636*	-.513*	.543*	1.000					
EPS <sub>g</sub>	-.169	-.670*	-.648*	.542*	.893*	1.000				
FR <sub>1</sub>	.134	.670*	.740*	-.315*	-.333*	-.457*	1.000			
FR <sub>2</sub>	.137	.399*	.524*	-.112	-.131	-.250	.899*	1.000		
SIZE	.624*	-.184	-.157	.400*	.178	.110	-.127	.040	1.000	
MR	-.079	-.437*	-.439*	.512*	.679*	.789*	-.341*	-.234	.011	1.000

\*Significant at 0.05 level

The growth of sales, EBIT, and EPS are all significantly and positively correlated. In spite of the differing variability between sales and EBIT and between sales and EPS, the trend growth in sales of a bank is maintained at the two income measures after accounting for operating and financial leverage. Sales growth and variability are significantly and positively correlated with bank size. The correlations between size and the other growth and variability measures are not significant.

The two proxies for financial risk are significantly correlated. Since  $FR_1$  (I/EBIT) relates to the cash flows of fixed interest debt and  $FR_2$  (LTD/EQ) relates to the stocks of debt and equity, it is noteworthy that these measures of two different aspects of financial risk are so closely related. In addition, both financial risk measures are significantly and positively correlated with EBIT variability. This result tends to deny the suggestion that banks may vary these two types of risks in different directions to attain some optimal level of over-all risk, as was supported by Sachlis and Haslem [15]. This conclusion is softened somewhat by the fact that these risk proxies are essentially averages over nearly an eight year period. Thus the dynamics of adjustment of the risk positions may well be obscured.

As part of the effort to better understand business risk in banking, equation (6) was estimated. Numbers in parenthesis are

$$(6) \quad EBIT_v = 0.378 + 2.393 SALES_v - 3.908 SALES_g - 0.030 SIZE$$

$$(4.01) \quad (3.66) \quad (-3.46) \quad (-2.25)$$

$$\bar{R}^2 = .326 \quad n = 55$$

t-statistics;  $\bar{R}^2$  is adjusted  $R^2$ . The purpose of equation (6) is to provide a multivariate test of the role of growth and size in determining business risk. Once the variability in EBIT induced by sales

variability is controlled for, growth exhibits a significant negative effect on the business risk proxy, consistent with the view of Martin, Scott and Vandell [10]. Also, size affects  $EBIT_v$  negatively and significantly, supporting the conventional view that larger size reduces risk. The three independent variables in equation (6) explain about one third of the variability in EBIT among the 55 banks. A portion of the remaining variability is due to the use of operating leverage, which has not been directly proxied here.

To examine how business and financial risk interact to determine variability in EPS, equation (7) was estimated.<sup>2</sup> The variability in

$$(7) \quad EPS_v = 0.011 + 0.334 EBIT_v - 0.098 EBIT_g + 0.059 FR_2 - 0.0014 SIZE$$

$$(0.39) \quad (6.37) \quad (-0.36) \quad (2.91) \quad (-0.43)$$

$$\bar{R}^2 = .692 \quad n = 55$$

earnings per share is positively and significantly affected by business risk ( $EBIT_v$ ) and financial risk ( $FR_2$ ), as would be expected. EBIT growth and size are not significant in explaining  $EPS_v$ . From an ex post income statement perspective the variability in "bottom line" earnings per share is explained largely (69%) by the two types of risk the firm encounters.

Similar tests for the influence of business and financial risk on market return were conducted using equation (8) where  $VAR_i$  is the

$$(8) \quad MR_i = a_0 + a_1 VAR_i + a_2 GROW_i + a_3 FR_{2i} + a_4 SIZE_i + E_i$$

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<sup>2</sup>If  $FR_1$  is substituted for  $FR_2$  in equation (7) the results are virtually unchanged.

measure of sales or EBIT variability and  $GROW_1$  is the measure of sales or EBIT growth for bank 1. The estimated coefficients of equation (8) using various VAR and GROW variable combinations are shown in Table 3.

Equation (8) is estimated using ex post data. It can be observed that from 28% to 48% of the variability in average market return among the 55 banks can be explained using these variables. Size has a consistently negative impact on market return, and growth, using either sales or EBIT growth, has a positive and significant impact. The coefficient of financial risk is consistently negative but rarely significant. Different levels of financial leverage among banks seem to have had little effect on ex post average market returns. The significant sales variability coefficients are positive; the significant EBIT variability coefficients are negative. This suggests that those banks with greater EBIT variability due to their cost structures have been penalized with lower market returns. The positive coefficients of sales variability indicate that higher levels of operating leverage have produced this negative effect, although it is not a strong effect.

## VI. Summary and Conclusions

Business risk is a useful concept in explaining the overall risk that a firm experiences. However, it is difficult to measure because of its future or expected dimension. In this study of business risk in commercial banking ex post variability in EBIT has been used as a proxy for this risk component. For the time period 1971:1 through 1978:3 EBIT variability across 55 commercial banks and bank holding companies is positively related to growth in sales and size. The proxy for business

TABLE 3

Estimated Regression of Coefficients of Equation (8) Using Average Market Return as the Dependent Variable

Line	Constant	Variability in:		Growth in:		FR <sub>2</sub>	Size	$\bar{R}^2$
		Sales	EBIT	Sales	EBIT			
1	0.012 (0.93)	-0.053 (-0.58)		0.724** (4.56)		-0.010 (-1.29)	-0.0019 (-1.02)	.284
2	0.016* (1.56)		0.009 (0.45)		0.543** (5.41)	-0.011* (-1.45)	-0.0012 (-0.95)	.455
3	0.029** (2.52)	0.150** (1.79)			0.567** (6.96)	-0.011* (-1.60)	-0.0032** (-1.98)	.485
4	0.022** (1.89)		-0.031** (1.68)	0.615** (3.65)		-0.005 (-0.64)	-0.0027** (-1.92)	.317
5	0.023* (1.56)	0.016 (0.16)	-0.032* (-1.57)	0.610** (3.54)		-0.005 (-0.62)	-0.0029* (-1.48)	.304
6	0.029** (2.30)	0.149** (1.71)	0.0001 (0.01)		0.568** (5.71)	-0.011* (-1.45)	-0.0032** (-1.89)	.475

\*\*significant at 0.05 level; \*significant at 0.10 level



risk is a significant explainer of the variability in book returns for commercial banks when included with measures of growth, size, and financial risk. Finally, the proxy for business risk adds only marginally to the explanation of average market return across 55 banks.

Thus, business risk is an important component in the overall risk of a commercial bank, a finding that may appear surprising if business risk is related to capital intensity. The cost structure of bank operations does have a significant impact on its risk. The findings here are limited by the use of a business risk proxy requiring nonnegative EBIT, and by the ex post nature of the empirical work. Future efforts to create a proxy for business risk that will incorporate negative values are necessary. In addition business and financial risk need to be integrated with market risk in any explanation of market return. Future research will have to deal with these issues.

Appendix: Banks in Sample

Bank of New York Co Inc  
Chase Manhattan Corp  
Manufacturers Hanover Corp  
Morgan (J.P.) & Co  
Continental Illinois Corp  
First Chicago Corp  
First Natl Boston Corp  
Harris Bankcorp Inc  
Mellon Natl Corp  
CBT Corp  
Continental Bank-Norristown  
Fidelity Union Bancorp  
First Natl State Bancorp  
Provident Natl Corp  
United Bank Corp of New York  
Alabama Bancorporation  
Banco Popular De Puerto Rico  
Dominion Bankshares Corp  
First Union Corp (N.C.)  
NCNB Corp  
South Carolina Natl Corp  
United Virginia Bankshares  
Virginia Natl Bankshares  
Wachovia Corp  
Bancohio Corp  
Centran Corp  
Clevetrust Corp  
Commerce Bancshares Inc  
Detroitbank Corp  
Equimark Corp  
First Bank System Inc  
First Union Bancorporation  
Manufacturers Natl Corp  
Mercantile Bancorporation  
National City Corp  
National Detroit Corp  
Northwest Bancorporation  
Pittsburgh Natl Corp  
Society Corp  
Arizona Bank Phoenix  
Colorado Natl Bankshares  
First City Bancorp (Texas)  
First Intl Bancshares  
First Natl Bancorporation  
Mercantile Texas Corp  
Southwest Bancshares  
Texas Commerce Bancshares  
United Banks of Colorado

Valley National Bank-Arizona  
Hawaii Bancorp Inc  
Rainier Bancorp  
Seafirst Corp  
Security Pacific Corp  
U S Bancorp  
Wells Fargo & Co

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